PREDATION BY FERAL CATS UPON LIZARDS

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The impact of both feral and domestic cats *Felis catus* on native wildlife has received increasing attention recently, in both the popular press and in scientific literature.

Paton (1991) reported on the loss of wildlife to domestic cats and found that the average domestic cat takes approximately 30 vertebrate prey items per year. This was considered to underestimate the true predation rate by as much as 50%. Predation on birds alone (an annual average of 8 birds per cat) accounted for approximately 50% of the standing crop of birds in suburban areas, because of the high density of cats in such areas. Paton (1991) concluded that suburban areas act as a sink for birds because of this high predation rate, and that this pressure could affect the populations of birds in surrounding regions.

Dickman (1993) has suggested that feral cats introduced prior to European settlement, perhaps as early as the seventeenth century from Dutch or Asian trading vessels, were responsible for the disappearance of several small (50–800 g) mammal species by the early nineteenth century. This pre-dated the decline of larger mammal species in the late nineteenth and early twentieth centuries which is believed to have been caused by the introduction and spread of the Red Fox *Vulpes vulpes* and to changes in fire regimes (Burbidge and McKenzie 1989). Dickman (1993) also notes that the disappearance of island populations of several mammal species, including the 4–10 kg Tammar Wallaby *Macropus eugeni*, has been linked with the introduction of cats.

There are many other observations on the impact of predation by cats upon native wildlife, but there are few data on the diet of feral cats. Coman and Brunner (1972), in an examination of the stomach contents of 80 feral cats collected in Victoria (primarily in the east of the state), found that the diet was 88% mammals by volume. Rabbits *Oryctolagus cuniculus* and House Mice *Mus musculus* were the most abundant mammals in the diet of cats in developed areas, but native mammals were more significant in the diet of cats living in native vegetation.

Brooker (1977), however, working on Western Australia's Nullarbor Plain, found the stomach contents of 9 cats to be composed mostly of a single lizard species, *Tympanocryptis lineata*, which accounted for 60% of 103 vertebrate prey items. Reptiles made up 101 of the vertebrate prey items, the remaining two items being birds. Traces of rabbit fur were found.

Chapman and Kitchener (1978) also

found reptiles to be a significant component of the diet in one stomach sample collected in Durokoppin Nature Reserve, in Western Australia's wheatbelt. Of 10 to 12 items, 2 were insects, 4 were lizards and 4 or possibly 6 were Gould's Wattled Bat *Chalinolobus gouldii*.

Jones (1989) summarizes information on feral cats and with respect to diet, concludes that they are generally opportunistic in their selection of prey items. Items taken reflect availability but cats are "first and foremost, predators of small, terrestrial mammals".

The impact of these sorts of predation by cats upon native wildlife can be difficult to assess, except in extreme cases, without information on the abundance of the prey species. Therefore, every opportunity should be taken to determine the diet of feral and domestic cats where data have been collected on the abundance of native fauna.

As part of the Environmental Management Programme of Tiwest Joint Venture, a sand-mining company working at Cooljarloo (30°40'S, 115°25'E) approximately 140 km north of Perth in Western Australia, detailed fauna studies have been conducted since 1986. These studies have involved intensive bird-censussing and pitfall-sampling for frogs, reptiles and small mammals in *Banksia* low woodland on Vacant Crown Land. The density of birds (found using an area-search technique) is in the order of 2–7 /ha, with honeyeaters being the most abundant group. Equivalent data are not available for frogs, reptiles and small mammals, but the relative abundances of different species from pitfall sampling are presented on Table 1. In addition, intensive searching and pitfall-trapping within fenced enclosures suggest lizard densities of *ca.* 400 individuals/ha, densities of the Honey Possum *Tarsipes rostratus* of *ca* 16/ha and densities of *M. musculus* of *ca* 30/ha (Bamford and Bamford, 1992 & 1993). It should be stressed that these density estimates for terrestrial vertebrates are only provisional results from ongoing studies.

Feral cats are occasionally seen at Cooljarloo, but on 6 November 1991, a freshly-killed specimen was found on the Brand Highway about 5 km south of the study area. The cat was black, male and with a total length (including tail) af 750 mm. It was not weighed, but was in good condition with heavy deposits of intestinal and sub-cutaneous fat. The stomach was full and contained the following items:

Reptilia
- Pygopodidae (legless lizards)
  - *Aclys concinnna*: 1;
  - *Delma grayi*: 2;
- Gekkonidae (geckoes)
  - *Diplodactylus spinigerus*: 2,
- Scincidae (skinks)
  - *Ctenotus fallens*: 7

Aves
- Meliphagidae (honeyeaters)
  - chicks: 2;

Mammalia
- small tufts of fur, probably rabbit.

Insecta
- Acrididae (grasshoppers)
  - unidentified species: 1.

Table 1. Numbers of captures of frogs, reptiles and small mammals in pitfall traps from 1989 to 1991 (13,110 trap-nights). Scientific names are based on: frogs (Tyler *et al.* 1984), reptiles (Storr *et al* . 1981, 1983, 1986 and 1990) and mammals (Strahan 1983 and Kitchener *et al.* 1984).

Species	No. caught	Percent. of total
FROGS		
Crinia pseudinsignifera	4	0.1
Heleioporus albopuncatus	4	0.1
Heleioporus eyrei	386	12.0
Limnodynastes dorsalis	5	0.2
Myobatrachus gouldii	220	6.8
Neobatrachus pelobatoides	254	7.9
Pseudophryne guentheri	90	2.8
REPTILES		
Aclys concinna	8	0.2
Aprasia repens	1	0.03
Delma grayii	1	0.03
Lialis burtonis	3	0.09
Pletholax gracilis	3	0.09
Diplodactylus alboguttatus	35	1.1
Diplodactylus spinigerus	36	1.1
Phyllodactylus marmoratus	9	2.8
Pogona minor	109	3.4
Tympanocryptis adelaidensis	418	13.0
Cryptoblepharus plagiocephalus	18	5.6
Ctenotus fallens	160	5.0
C. gemmula	63	2.0
C. impar	165	5.1
C. lesueurii	13	0.4
C. pantherinus	2	0.06
Egernia napoleonis	3	0.09
Lerista elegans	15	0.5
L. praepedita	20	0.6
Morethia lineoocellata	52	1.6
M. obscura	130	4.0
Ramphotyphlops australis	3	0.09
Notechis curtus	3	0.09
Rhinoplocephalus gouldii	1	0.03
Vermicella calonotus	2	0.06
MAMMALS		
Sminthopsis dolichura	13	0.4
S. granulipes	7	0.2
S. griseoventer	2	0.06
Tarsipes rostratus	549	17.1
Mus musculus	251	7.8
Pseudomys albocinereus	144	4.9
Rattus fuscipes	11	0.3
TOTAL	3213	

As the stomach contents were fresh, this sample represents prey items taken over one night only, and possibly over only part of that night. Although small mammals are abundant in the area where the cat had been foraging (small mammals comprised 30% of pitfall captures), none was present in the sample. The abundance of reptiles in the sample probably reflects their abundance in the area where the cat had been foraging, and possibly also the ease of capture. Jones (1989), however, states that reptiles are only an important dietary item in arid areas, whereas Cooljarloo has a mediterranean climate with reliable winter rainfall. The importance of mammals in the diet of cats suggested by Jones (1989) possibly reflects a south-eastern Australian bias to most data on the diet of cats. Small mammals may simply be abundant in eastern Victoria, for example, where Coman and Brunner (1972) found mammals to be the most numerous prey items.

Most of the reptiles were presumably taken when inactive, although *D. spinigerus* is nocturnal and some species of pygopodids are crepuscular (pers. obs.). The reptiles present had all been recorded in pitfall-sampling but were not the commonly-caught species (Table 1). This may be due to a bias on the part of the cat, or to a bias in the pitfall sampling. Intensive searching suggests that *Tympanocryptis adelaidensis*, although freqently pitfalled, is not as abundant as suggested by pitfall data, while geckoes and pygopodids are more abundant than the numbers of captures in pitfalls would indicate. The capture of a single *D. grayi* during pitfall trapping over three years, compared with the capture of two by the cat in one night of foraging, is nonetheless remarkable. Possibly, *D. grayi* is vulnerable to predation by cats by virtue of its behaviour.

Paton (1991) estimates the density of domestic cats in rural areas as 0.01/km^2, while Jones and Coman (1982) report densities of feral cats as 0.34 to 3.5 cats/km^2. It is possible to estimate the impact of cat predation on reptile numbers at Cooljarloo by taking an estimate of the density of cats, the density estimate of 400 lizards per ha and the number of lizards eaten by the road-killed cat in one night. The same cannot realistically be done with nestling honeyeaters, as the density estimates for birds are for adults only. If a value of 1 cat/km^2 is used, then predation by feral cats at Cooljarloo could account for 4,380 reptiles per km^2 annually. This accounts for 11%. of the estimated 40,000 lizards/km^2.

These calculations clearly make many assumptions and are based on a small data set, but they indicate that feral cats may be significant predators of reptiles. Furthermore, if their predation concentrates on a few species, then the proportion of these species' populations being taken annually may be very high indeed. More detailed data on the diet of cats and on the abundance of their prey items would make it possible to be more confident of the significance of cat predation on native fauna.

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